

CLAIMS

What is Claimed Is:

1. At least one mechanical counterbalance for use in balancing a disk pack that includes a spindle motor rigidly coupled and aligned by at least two open screw holes with a disk clamp, comprising:

a locking plate collection comprising a disk clamp and a spindle motor

5 a cylindrical shaft rigidly coupled to a latching assembly, both centered around a primary axis, and a balance weight;

wherein said latching assembly includes a compressible latch rigidly coupled to a latch gap zone, both centered around said primary axis;

wherein said balance head is rigidly coupled to said latch gap zone;

10 wherein said cylindrical shaft is rigidly coupled to said compressible latch;

wherein for each of said open screw holes, when said mechanical counterbalance is inserted into said open screw hole to lock said mechanical counterbalance,

said cylindrical shaft fits into said open screw hole,

said compressible latch compresses while passing through said disk clamp; and

15 said compressible latch expands after passing through said disk clamp;

wherein said mechanical counterbalance has a total mass provided at essentially said primary axis when used in said disk pack.

2. The apparatus of Claim 1, wherein said mechanical counterbalance is primarily composed of one material formed into said cylindrical shaft, said latching assembly and said balance weight;

wherein said material is at least one member of the collection comprising said material is
5 essentially a plastic, and said material is castable.

3. The apparatus of Claim 2, wherein said plastic is a nylon.

4. The apparatus of Claim 1, wherein said mechanical counterbalance is free of each member of a contaminant collection comprising a particle larger than a first specification, a hanging burr larger than a second specification, and a contaminant determined by a third specification;

5 wherein each of said first specification, said second specification, and said third specification, is derived from a reliability specification used in the manufacturing said hard disk drive.

5. The apparatus of Claim 1, wherein said mechanical counterbalance locks against said disk clamp.

6. The apparatus of Claim 1, said locking plate collection further comprising at least one of said disk spacers.

7. The apparatus of Claim 1, wherein said compressible latch includes at least one member of a latch collection comprising a compressible ridge ring, and an M compressible fin ring; wherein M is at least two.

8. A method of making a balanced disk pack, for a hard disk drive, from a disk pack including a spindle motor rigidly coupled, and aligned by at least two open screw holes, with a disk clamp,

wherein said method comprises, for each of said open screw holes, of the steps of:

5 analyzing said disk pack for a balancing operation for said open screw hole;

performing said balance operation for said open screw hole, further comprising said steps of:

selecting a mechanical counterbalance for said open screw hole to create a selected counterbalance of a total mass, if a balance action is determined for said open screw hole; and

10 inserting said selected counterbalance into said open screw hole until said mechanical counterbalance locks into said open screw hole to at least partially create said balanced disk pack, if said balance action is determined for said open screw hole.

9. The method of Claim 8, wherein the step selecting said mechanical counterbalance for said open screw hole further comprising the step of:

selecting said mechanical counterbalance for said open screw hole from a counterbalance collection and from a counterbalance mass collection to create said selected counterbalance with
5 said total mass;

wherein said mechanical counterbalance mass collection comprising at least two members;

wherein said total mass is a member of said mechanical counterbalance mass collection;

wherein each of said members of said mechanical counterbalance mass collection
10 approximates the total mass of at least one member of said mechanical counterbalance collection; and

said selected counterbalance is an instance of a member of said mechanical counterbalance collection.

10. The method of Claim 8, wherein the step inserting said selected counterbalance into said open screw hole further comprising the steps of:

fitting said selected counterbalance into said open screw hole; and

locking said selected counterbalance into said open screw hole against a member of a
5 locking plate collection after fitting said selected counterbalance into said open screw hole;
wherein said locking plate collection comprising said disk clamp and said spindle motor.

11. The method of Claim 10, wherein the step locking said mechanical counterbalance into said open screw hole further comprising the steps of:

compressing a compressible latch in said open screw hole; and

expanding said compressible latch after compressing said compressible latch in said open
5 screw hole to lock said mechanical counterbalance against said locking plate collection member.

12. The method of Claim 11, wherein said compressible latch includes at least one member of a latch collection comprising a compressible ridge ring, and an M compressible fin ring; wherein M is at least two.

13. The method of Claim 10, wherein said locking plate collection further comprising at least one disk spacer.

14. The method of Claim 10, wherein the step locking said selected counterbalance into said open screw hole further comprising the step of:

locking said selected counterbalance into said open screw hole against said disk clamp after fitting said mechanical counterbalance into said open screw hole;

5 wherein said method further comprising the steps of:

confirming a balance failure of said disk pack after locking said mechanical counterbalance;

removing said disk clamp and all of said mechanical counterbalances locked to said disk clamp to create a partial disk pack; and

10 rigidly coupling a second disk clamp to said spindle motor of said partial disk pack, and aligning by said open screw holes, to recreate said disk pack.

15. The method of Claim 8, wherein the step analyzing said disk pack for said balancing operation for said open screw hole further comprising the step of:

using a disk pack balance instrument to analyze said disk pack for said balancing operation.

16. Said balanced disk pack as a product of the process of Claim 8.

17. A method of making a hard disk drive, comprising the step of: using said balanced disk pack of Claim 16 to create said hard disk drive.

18. Said hard disk drive as a product of the process of Claim 17.

19. An apparatus operating upon said disk pack to create said balanced disk pack, comprising, for each of said steps of Claim 8, the means for implementing said step.

20. The apparatus of Claim 19, wherein at least one of said means is implemented using at least one member of the collection comprising an assembly workstation, a computer controlling at least part of said assembly workstation, a memory accessibly coupled with said computer, a program step residing in said memory to direct said computer in implementing said means, a finite state machine controlling at least part of said assembly workstation.

21. Said mechanical counterbalance of Claim 8, comprising, for at least one of said open screw holes, of:

means for inserting said mechanical counterbalance into said open screw hole until said mechanical counterbalance locks into said open screw hole, further comprising:

means for fitting said mechanical counterbalance into said open screw hole;

means for locking said mechanical counterbalance into said open screw hole against a member of a locking plate collection after fitting said selected counterbalance into said open screw hole;

wherein said mechanical counterbalance has a total mass provided at essentially said primary axis when used in said disk pack.

22. The apparatus of Claim 21, wherein said mechanical counterbalance is primarily composed of one material forming said means;

wherein said material is at least one member of the collection comprising said material is essentially a plastic, and said material is castable.

23. The apparatus of Claim 22, wherein said plastic is a nylon.

24. The apparatus of Claim 21, wherein the means for locking said mechanical counterbalance into said open screw hole against said locking plate collection member after fitting said selected counterbalance into said open screw hole further comprising:

means for compressing a compressible latch in said open screw hole, and

means for expanding said compressible latch after compressing said compressible latch in said open screw hole to lock said mechanical counterbalance against said locking plate collection member.

25. The apparatus of Claim 24, wherein said compressible latch includes at least one member of a latch collection comprising a compressible ridge ring, and an M compressible fin ring; wherein M is at least two.

26. The apparatus of Claim 21, wherein said mechanical counterbalance is free of each member of a contaminant collection comprising a particle larger than a first specification, a hanging burr larger than a second specification, and a contaminant determined by a third specification;

5 wherein each of said first specification, said second specification, and said third specification, is derived from a reliability specification used in the manufacturing said hard disk drive.

27. The apparatus of Claim 21, wherein said mechanical counterbalance locks against said disk clamp.

28. The apparatus of Claim 21, wherein said locking plate collection further comprising at least one of said disk spacers.